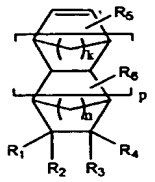
WHAT IS CLAIMED IS:

1. A photoresist copolymer derived from a mixture of monomers comprising:

(a) two or more alicyclic olefin derivatives of the formula:

<Chemical Formula 4>



wherein

k and n is independently 1 or 2;

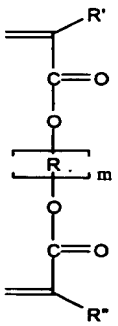
p is an integer from 0 to 5;

R_5 and R_6 are independently hydrogen or methyl; and

R_1, R_2, R_3, and R_4 individually represent hydrogen, straight or branched C_{1-10} alkyl, straight or branched C_{1-10} ester, straight or branched C_{1-10} ketone, straight or branched C_{1-10} carboxylic acid, straight or branched C_{1-10} acetal, straight or branched C_{1-10} alkyl including at least one hydroxyl group, straight or branched C_{1-10} ester including at least one hydroxyl group, straight or branched C_{1-10} ketone including at least one hydroxyl group, straight or branched C_{1-10} carboxylic acid including at least one hydroxyl group, and straight or branched C_{1-10} acetal including at least one hydroxyl group,

wherein, at least one of R_1, R_2, R_3, and R_4 represent straight or branched C_{1-10} alkyl including at least one hydroxyl group, straight or branched C_{1-10} ester including at least one hydroxyl group, straight or branched C_{1-10} ketone including at least one hydroxyl group, straight or branched C_{1-10} carboxylic group including at least one hydroxyl group, straight or branched C_{1-10} acetal including at least one hydroxyl group; and

(b) a cross-linking monomer of the formula:



wherein

each of R' and R" is independently hydrogen or methyl;

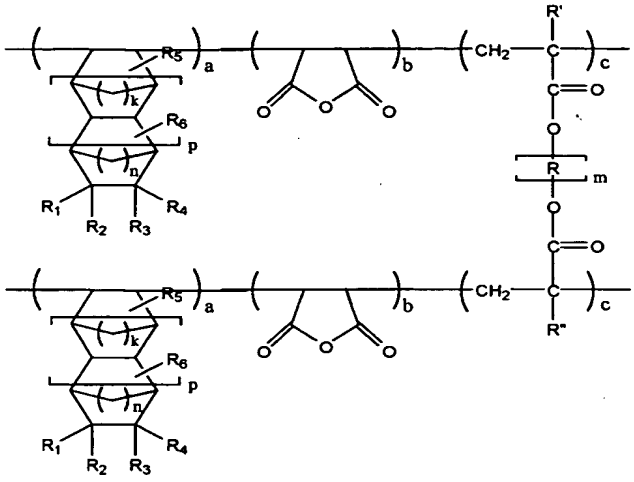
m is an integer from 1 to 10; and

R is straight or branched C_{1-10} alkyl, optionally comprising an ester, a ketone, a carboxylic acid, an acetal, a hydroxyl group or a combination thereof.

2. The photoresist copolymer according to claim 1, wherein said mixture of monomers further comprises maleic anhydride.

3. The photoresist copolymer according to claim 1 of the formula:

<Chemical Formula 5>

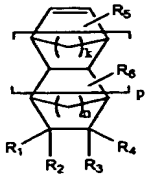


wherein

k, m, n, p, R, R_1, R_2, R_3, R_4, R_5, R_6, R', and R" are those defined in Claim 1; and the ratio a : b : c is 1-50 mol% : 10-50 mol% : 0.1-20 mol%.

4. The photoresist polymer according to claim 3 comprising poly(maleic anhydride / 2-hydroxyethyl 5-norbornene-2-carboxylate / tert-butyl 5-norbornene-2-carboxylate / 5-norbornene-2-carboxylic acid / 1,3-butanediol diacrylate); or poly(maleic anhydride / 2-hydroxyethyl 5-norbornene-2-carboxylate / tert-butyl 5-norbornene-2-carboxylate / 5-norbornene-2-carboxylic acid / 1,4-butanediol diacrylate).

5. A process for preparing a photoresist copolymer comprising admixing at least two alicyclic monomers, a cross-linking monomer and a polymerization initiator under polymerization reaction conditions sufficient to produce the photoresist copolymer, wherein the alicyclic monomer is of the formula:



wherein

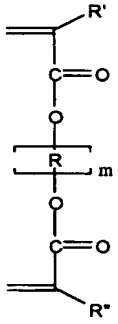
k and n is independently 1 or 2;

p is an integer from 0 to 5;

R_5 and R_6 are independently hydrogen or methyl; and

R_1, R_2, R_3, and R_4 individually represent hydrogen, straight or branched C_{1-10} alkyl, straight or branched C_{1-10} ester, straight or branched C_{1-10} ketone, straight or branched C_{1-10} carboxylic acid, straight or branched C_{1-10} acetal, straight or branched C_{1-10} alkyl including at least one hydroxyl group, straight or branched C_{1-10} ester including at least one hydroxyl group, straight or branched C_{1-10} ketone including at least one hydroxyl group, straight or branched C_{1-10} carboxylic acid including at least one hydroxyl group, and straight or branched C_{1-10} acetal including at least one hydroxyl group,

wherein, at least one of R_1, R_2, R_3, and R_4 represent straight or branched C_{1-10} alkyl including at least one hydroxyl group, straight or branched C_{1-10} ester including at least one hydroxyl group, straight or branched C_{1-10} ketone including at least one hydroxyl group, straight or branched C_{1-10} carboxylic group including at least one hydroxyl group, straight or branched C_{1-10} acetal including at least one hydroxyl group; and the cross-linking monomer is of the formula:



wherein

each of R' and R" is independently hydrogen or methyl;

m is an integer from 1 to 10; and

R is straight or branched C_{1-10} alkyl, optionally comprising an ester, a ketone, a carboxylic acid, an acetal, a hydroxyl group or a combination thereof.

6. The process for preparing a photoresist copolymer according to claim 5, wherein the polymerization reaction is carried out under an atmosphere of nitrogen or argon.

7. The process for preparing a photoresist copolymer according to claim 5, wherein the polymerization reaction is carried out at a temperature between 60°C and 130°C.

8. The process for preparing a photoresist copolymer according to claim 5, wherein the polymerization reaction is carried out under the pressure between 0.0001 and 5 atm.

9. The process for preparing a photoresist copolymer according to claim 5, wherein the admixture further comprises an organic solvent selected from the group consisting of cyclohexanone, methyl ethyl ketone, benzene, toluene, dioxane, tetrahydrofuran, propylene glycol methyl ether acetate, dimethylformamide, and a mixture thereof.

10. The process for preparing a photoresist copolymer according to claim 5, wherein the polymerization initiator is one or more compound(s) selected from the group consisting of 2,2-azobisisobutyronitrile (AIBN), acetyl peroxide, lauryl peroxide, tert-butyl peracetate, tert-butyl hydroperacetate and tert-butyl peroxide.

11. The photoresist composition comprising (i) a photoresist copolymer according to claim 1, and (ii) an organic solvent.

12. The photoresist composition according to claim 11, which further comprises a photoacid generator.

13. The photoresist composition according to claim 12, wherein the photoacid generator is one or more compound(s) selected from the group consisting of diphenyl iodide hexafluorophosphate, diphenyl iodide hexafluoroarsenate, diphenyl iodide hexafluoroantimonate, diphenyl p-methoxyphenyl triflate, diphenyl p-toluenyl triflate, diphenyl p-isobutylphenyl triflate, diphenyl p-tert-butylphenyl triflate, triphenylsulfonium hexafluorophosphate, triphenylsulfonium hexafluoroarsenate,

triphenylsulfonium hexafluoroantimonate, triphenylsulfonium triflate, and dibutylnaphtylsulfonium triflate.

14. A process for forming a photoresist pattern, which comprises the steps of (a) coating a photoresist composition according to claim 11 on a wafer, (b) exposing the wafer to patterned light by employing an exposer, and (c) developing the exposed wafer.

15. The process for forming a photoresist pattern according to claim 14, wherein the step (b)is carried out by using a light source selected from the group consisting of ArF, KrF, E-beam, X-ray, EUV (extremely ultraviolet) and DUV (deep ultraviolet).

16. The process according to claim 15, which further comprises baking step(s) before and/or after step (b).

17. The process according to claim 16, wherein the baking step(s) are performed at a temperature of 50°C to 200°C.

18. The process according to claim 14, wherein the developing step (c) is carried out using an aqueous solution of TMAH (tetramethylamine hydroxide).

19. A semiconductor element manufactured by using a process according to claim 14.